national accelerator laboratory

EXP-31
February 1, 1973

ACCELERATOR EXPERIMENT--Efficiency and Losses Versus Parking Position and Angle

Experimentalists: H. E. Fisk and F. Hornstra

Date Performed: 30 January 1973

This experiment is a prelude to a series of experiments designed to obtain a family of curves showing the relationship of the extraction efficiency and extraction losses to the parking position and angle of the beam. It is believed that zero current in the angle magnet is optimum for the nominal parking position current of 20 amps; however, this condition is an extrapolation of tuning for fast pinged beam and may not be optimum for slow resonant extraction.

Data for the attached curves were taken during the approximately one hour of beam available on January 30, 1973.

The following observations can be made from the attached curves:

1. Optimum operating conditions are obtained by maximizing efficiency; however, this condition is achieved with more sensitivity by also minimizing the losses. Theoretically the efficiency ε is given by the following expression

$$\varepsilon = 1 - \frac{d}{\Delta R}$$

where d = apparent septum thickness
ΔR = step size/turn

or simply

$$\varepsilon = 1 - \text{loss}$$

therefore, measuring the loss is not only more direct but offers a tool to evaluate the ratio $\frac{d}{\Delta R}$.

2. The machine was not operating at optimum parking radius as indicated by the loss at the electrostatic septum. Clearly, 15 to 20 percent less loss can be achieved by parking near 15 amps rather than 20 amps. Only a small corresponding increase in efficiency is indicated.

3. It is not clear that the proton beam ever directly strikes the cathode. The argument is as follows. Parking the beam radially out close to the electrostatic septum would favor the beam hitting the wires and losses would increase as the beam was parked more radially out. This result is exhibited on the right side of the graph and a slope corresponding to beam loss on wires is obtained. On the other hand, as the beam is moved radially in (away from the wire septum), one expects the step size of the peeling process to increase to the extent that the cathode would be hit directly by the proton beam; i.e., the step size would become too large. The amount of material in the cathode being substantially larger than that in the wires should cause the loss detector to register a significantly larger signal. As both plots show, the slope of the loss vs. position on the left is roughly the same as the one on the right.

F. Hornstra

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ENGINEERING NOTE

SECTION	PROJECT	SERIAL-CATEGORY	PAGE
		EXP-31	3

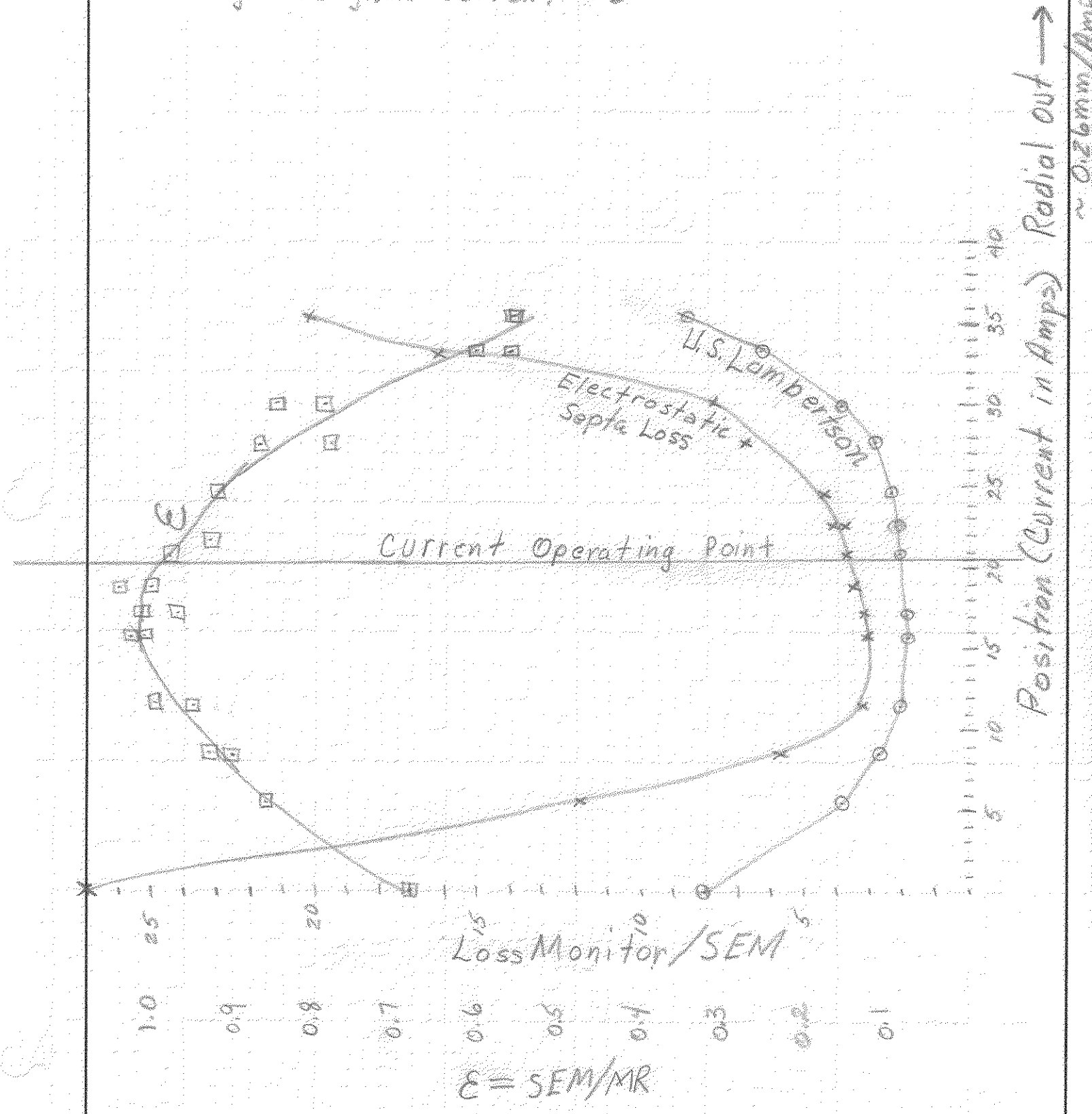
SUBJECT: Efficiency and Losses Versus Extraction Parking Position

NAME: Hornstra

DATE: 30 Jan 73

REVISION DATE:

Angle Magnet Current = 0



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ENGINEERING NOTE

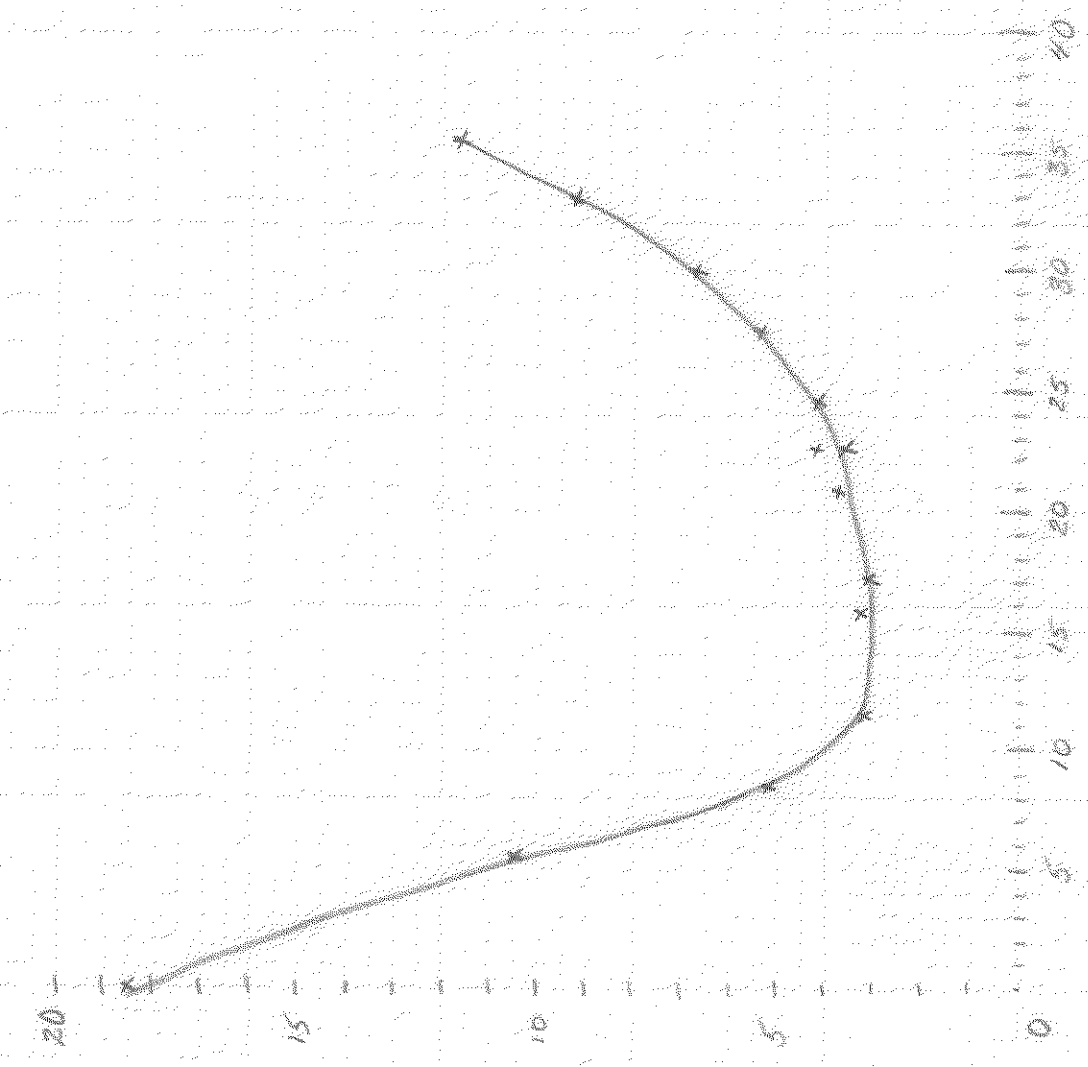
SECTION	PROJECT	SERIAL-CATEGORY	PAGE
		EXP-31	4

SUBJECT: Electrostatic Loss Monitor Versus MR Intensity

NAME: Hornstra

DATE: 30 Jan 73

REVISION DATE:



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